

## VII. Literature Review: Effects of Recreational Activities on Birds of Prey.

### Introduction

As leisure time and disposable income have increased, and transportation has improved, public demand for recreational opportunities has also been on the rise. Fishing and non-consumptive recreational activities are projected to increase 63% to 142% over the next 50 years (Flather and Cordell 1995). In response to this public interest, many land management agencies have increased their attention on recreation resources, including wildlife viewing programs. At the same time, there is a trend toward less recreational opportunity and access on private lands. These factors add up to increased pressure on public lands to provide recreation opportunities.

River corridors and lakes are key recreation destinations. The Snake River corridor, our study area, is certainly a primary recreation destination in this region. Riparian corridors, such as the South Fork, are also recognized as some of the most rare and thus most crucial wildlife habitats in the western United States (Behnke 1979, Carothers 1977). For example, the South Fork of the Snake River supports the highest density of nesting bald eagles in Idaho, and is home to a greater diversity of wildlife species than any other habitat in the region.

Recreation surveys performed between 1980 and 1992 on the South Fork of the Snake River estimated recreation use and identified recreational visitor profiles (USDI and USDA 1991, Pratt 1992). The South Fork was the final destination of an estimated 225,000 visits annually. Recreational visitor use and access were split between boaters (57%) and those recreating from the shore (43%). The season of use extends from May through November and closely follows the fishing season. The peak period of recreational use in the canyon portion of the South Fork is during the trout fly hatch, which lasts for two weeks in July. The season of use on the lower portions of the River (Heise to Roberts Bridge) extends from March to November. The 61 mile stretch of the Snake River from Palisades Dam to its confluence with the Henry's Fork is accessible to the everyday boater and hiker, and is striking in its natural beauty and wildlife bounty. It is within this narrow ribbon of important habitat that people and wildlife come face to face.

In part because recreational activities often take place over large areas, there is a perception that recreational impacts are benign to wildlife (Flather and Cordell 1995). Recently, it has become more widely accepted that wildlife is impacted directly and indirectly by recreational activities. The actual impacts, their causes and results, however, are not well understood (Knight and Cole 1995). This literature review of the impacts of recreational activities on wildlife, is conducted in the interest of the 19 species of raptors that reside within the Snake River Study Area.

## Methods

We reviewed published and unpublished works that address human disturbance on birds of prey. Much of the older literature and research looked at effects of human presence, and was not specific to recreational activities. We included those papers which had findings applicable to our topic. Many of the effects upon raptors are related to the presence of people, without regard to the type of human activity. For example, a disturbed raptor may not differentiate between humans taking water samples or humans fishing, walking to work or hiking. Those few papers specific to recreational effects upon raptors have focused on a few species, the bald eagle being most often studied. No literature was found that addressed human disturbance effects on owls. The references section includes some papers that, although not cited, do contain pertinent information on recreation effects.

## Literature Findings

After reviewing 536 references on the effects of non-consumptive recreation activities to wildlife, Boyle and Samson (1985) concluded that human impacts include direct mortality, habitat alteration and disturbance. Knight and Cole (1995) added pollution of wildlife environments and systems as another possible effect of human presence. The most immediate response of wildlife to these impacts is either death (exploitation) or a change in behavior. Knight and Cole (1995) go on to describe the long term effects of human disturbance to individuals, populations and communities (Figure 1).

The direct effects of these impacts are easily identified, such as the permanent loss of an individual animal, loss of a nest tree, or short term displacement of individuals. Direct effects are often more readily addressed and mitigated than indirect effects during project analysis. Many direct effects impact individual animals or family groups. However, even short term impacts to an individual may eventually impact an entire population or animal community over a long period of time (Cole and Landres 1995).

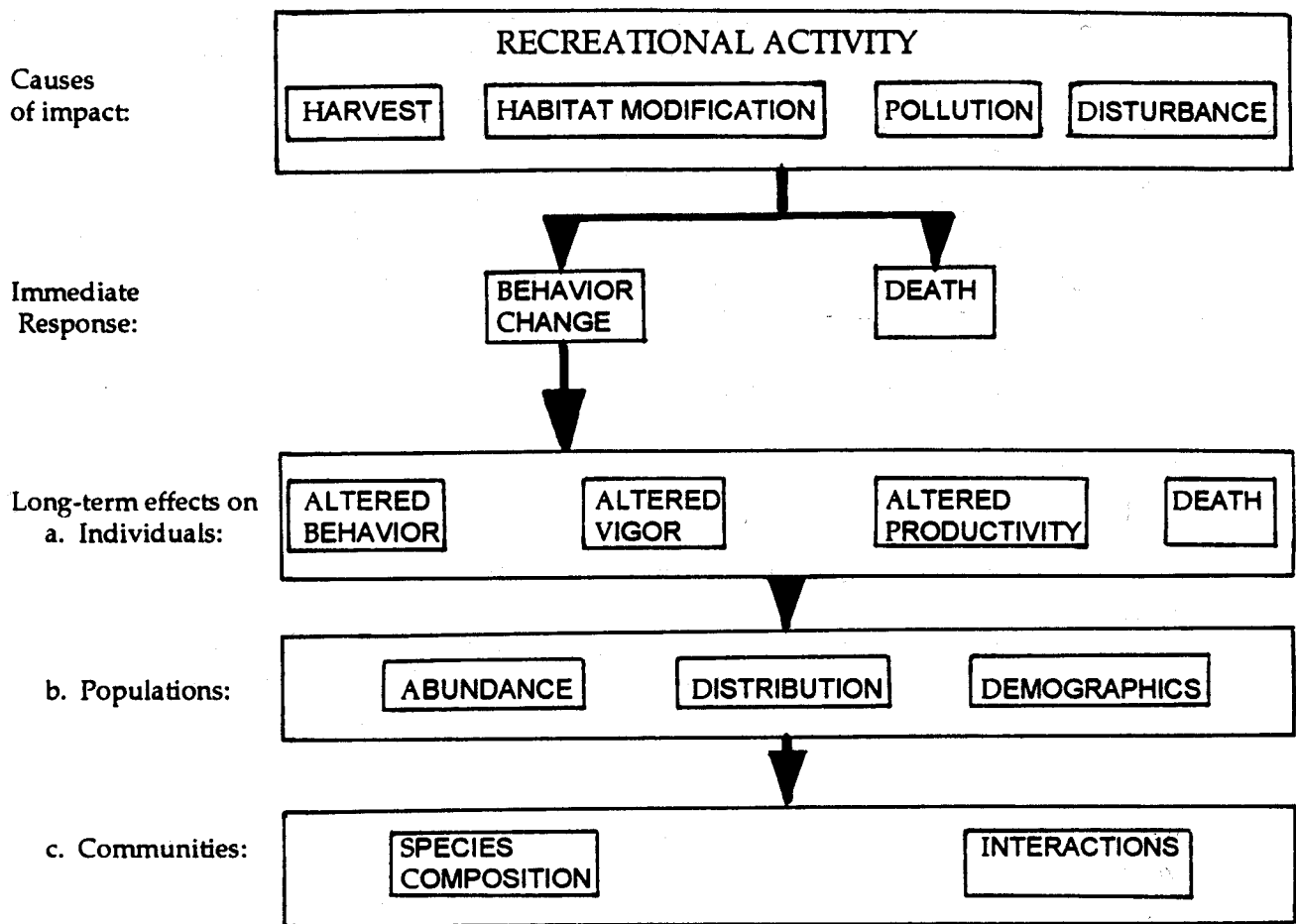


Figure 7. Wildlife responses to recreational activities, a conceptual model (from Knight and Cole 1991)

Cole and Landres (1995) reviewed the literature on indirect effects of recreation on wildlife, and noted that virtually all recreational activities alter some soil, vegetation and aquatic system characteristics. Habitat alterations ultimately influence the behavior, survival, reproduction and/or distribution of wildlife by affecting their food and space. Human presence, even in the absence of habitat alteration, is known to cause bird displacement, and reduction in reproduction and survival. For example, even low levels of intrusion have resulted in reduced primary singing in passerine birds. Primary singing is used to attract mates, secure territories and maintain pair bonds (Gutzwiller et. al. 1997). This type of impact can ultimately effect reproductive success.

An important point made by Cole and Landres (1995) is that, over a long period of time, effects on individual animals will eventually impact populations, communities and ecosystems. They also note that 1) indirect impacts are inevitable wherever and whenever recreational activities occur; and 2) indirect impacts generally occur for a long period of time, with effects that are long-lasting and may occur after a time lag. These qualities may make timing restrictions and user education programs relatively ineffective mitigation measures against ongoing indirect effects.

If recreational impacts affect the density and distribution of species which functionally dominate a system or community, the impacts can have severe long-term effects (Cole and Landres 1995). This observation is pertinent to raptors, because they reside at or near the top of food chains. Skagen et al. (1991) noted an example of this effect when the presence of anglers along a river resulted in a decline in bald eagles. This decline meant less food availability for other scavenging birds, which relied on a large bird like the bald eagle to open carcasses.

An example of a reverse form of "trophic cascade" was the displacement of bald eagles from McDonald Creek in Glacier National Park. Introduction of non-native opossum shrimp in the Flathead River-Lake ecosystem caused the collapse of the kokanee salmon population, and in turn, displaced bald eagles that had traditionally stopped during fall migration (Spencer et al. 1991). Bald eagle counts declined from 639 birds, tallied in a single count in 1981, to 25 birds seen in 1989. The indirect effect of this displacement is the increased potential of bald eagle mortality during migration and winter, especially to juvenile birds, if equitable alternate foods are not available (McClelland et al. 1983).

The magnitude of an animal's response to the impacting activity is influenced by characteristics of the disturbance and the individual animal. Factors such as timing, type, intensity, frequency, duration, predictability, extant and location of the disturbance can influence the severity of the impact. For example, disturbances to birds of prey during nest building and incubation have resulted in more reproductive failures than disturbances during the nestling period (Knight and Skagen 1988). Nest site abandonment, resulting in lower reproductive success, has been documented for osprey and ferruginous hawk (Dunstan 1968, Swenson 1979, Van Daele and Van Daele 1982, White and Thurow 1985). Short-term displacement during the nesting period can increase the vulnerability of eggs or nestlings to predation (Bortolotti et al. 1984, Fyfe and Olendorff 1976). Any displacement can affect the vigor of the individual through decreased energy gain, if the bird was displaced while foraging, or forced to increase energy expenditure (Stalmaster 1983). Reduced food intake or increased energy expenditure during the breeding period can impact the year's reproductive success (Swenson 1975, White and Thurow 1985).

Many researchers have noted specific "distances of tolerance" beyond which most individuals studied are displaced by approaching people (Holmes et al. 1993, Grubb et al. 1992, Fraser et al. 1985, Knight and Knight 1984, Russell et al. 1980, Whitfield and

Maj 1995). Bald eagles responded most to human disturbances originating from water and gravel bars, and to a lesser degree from land-related disturbances (Stalmaster and Newman 1978). Even subtleties such as a direct approach versus a tangential approach resulted in different responses from birds (Young 1981). People walking have typically generated more negative responses from wildlife than people approaching in vehicles (Holmes et al. 1993, Klein 1993). However, mechanized forms of recreation have many side or indirect effects such as destruction and trampling of vegetation and ground, which can affect prey composition and abundance, and noise and other environmental pollutants (Bury 1978).

Factors such as previous exposure to disturbance, individual size, age, and color, group size and composition, and nutritional state of the individual also influence the response of the animal to disturbances (Holmes et al. 1993, Skagen et al. 1991, Knight et al. 1989, Dunne et al. 1988, Clark and Wheeler 1987, Stewart and Newman 1978). Wintering raptors, including rough-legged hawks, kestrels, and ferruginous hawks, responded differently to disturbance depending on their spatial context (Holmes et al. 1993). Birds closer to roads displaced at greater distances and ground perched birds flushed at greater distances than those perched higher or away from roads. Birds found along paved roads have been described as habituated to typical vehicle disturbances. It has been suggested that this response may be that more tolerant birds use more disturbed sites (Fraser et al. 1985, Buehler et al. 1991, McGarigal et al. 1991).

Knight et al. (1987) believe that in areas where direct persecution is not a problem, birds that habituate to human activity have the adaptive edge in pursuit of their life needs, food and space. With both passerines and raptors, flushing distances increase with body size (Holmes et al. 1993, Cooke 1980). Large birds have been noted to flush at longer distances than small-sized birds. This may be because large birds are greater targets of persecution, or because smaller-sized birds are more hesitant to flush because they expend more energy relative to larger birds because of their larger surface area to body mass ratio.

### Summary and Conclusions

It is fair to acknowledge that it is difficult to measure the impact of human disturbances upon birds of prey. Raptor species generally have large home ranges, low population densities, and high mobility. Many species, e.g. nocturnal raptors, are inconspicuous by their nature. Raptor reproduction, which may depend upon many conditions such as annual climate and prey base fluctuations, can vary widely from year and to year. There is also great variability in individual animal response to human presence, variability which appears to be related to many factors. So where does this leave the manager who wants to apply the most appropriate strategy to minimize human disturbance on birds of prey?

Two primary approaches which have been used to minimize recreational impacts on raptors are: 1) prevent people from entering certain areas or zones, and 2) use

management strategies that allow both people and raptors to coexist (Olendorff and Kochert 1977). This later approach requires species-specific information on habitat relationships and response to recreational activities.

The combination of both approaches are currently in place on the South Fork of the Snake River (USDI and USDA 1991). Spatial and temporal restrictions have been placed at bald eagle nest sites along the river. Between Conant and Black Canyon, camping is restricted to 15 designated sites. This approach attempts to restrict inappropriate and disturbing activities during the crucial nesting period, and also serves to protect and potentially maintain certain habitat conditions and features. The success of this approach is measured in productivity and long-term displacement or abandonment of nest sites. We caution that using productivity or abandonment as a sole measure of success is an "all or nothing" measure. Until the critical threshold is reached and the birds have reproductive failure or leave the area, there is no prior measure of the impact. Studies have been conducted that looked at disturbance-induced changes in breeding ecology of bald eagles (Young 1980). Such studies are labor and resource intensive, but can disclose important information.

Research has found that the amount of human use and amount of impact to wildlife are related in a curvilinear manner. As use levels increase, additional use of the same type may have less and less impact. Cole and Landres (1995) suggest that, in some cases, limiting use levels to reduce indirect impacts may only be effective when use is virtually eliminated. Conservation of especially rare and vulnerable raptorial species, such as the California condor, has required setting aside large areas where people are excluded and management is designed to favor the species. This approach is considered extreme and undesirable, but may be the necessary approach to conserving rare or especially vulnerable species and habitats.

Development of proper management strategy is hampered by complexities that fog our understanding of the cause and effects of disturbances on wildlife. Gutzwiller (1991, 1993) is a strong proponent of experimental research with control of certain human-related variables. Controlled, experimental approaches allow a more direct evaluation of cause and effect. Field experiments are a realistic approach to increasing our understanding of impact processes (Walters and Hollings 1990). Although this approach may require a greater immediate outlay of resources, and some loss of the birds under study, it is probably the most expedient approach to answering cause and effect questions.

Evaluation of recreational activities and their impacts to raptors of the South Fork of the Snake is timely, and should be an on-going process. The South Fork continues to grow in popularity for recreational groups, as more people, in more and different ways, visit the river. Additionally, substantial human development and habitat changes are taking place on adjacent private lands. These factors are likely interacting synergistically to effect birds of prey.

Species which have their entire home range along the long and relatively narrow river corridor are particularly susceptible to fragmentation, widespread disturbance and additive impacts. The bald eagle fits this profile. In our judgment, the BLM's approach to research and management practices directed towards the bald eagle has been quite appropriate. Many other species with more general habitat needs focus their activities along this corridor owing to habitat loss on lands adjacent to the river corridor.

Cavity nesting raptors, such as kestrels, and northern pygmy, flammulated, western screech and saw-whet owls, are an example of a group of species which react to human activities in a multitude of ways. These birds are impacted by loss of suitable cavity nesting trees, unavailability of cavities with the increase of competing species, which often increase in the presence of man (Craighead and Mindell 1981), and reduced prey and direct poisoning by insecticides used on adjacent private lands, among other factors.

Birds of prey are one of the important resources that bring people to the South Fork, and a source of recreational enjoyment. More importantly, the raptorial birds that use the river corridor have tremendous intrinsic value in the ecological functions of the entire biological community. Long-term conservation of this resource, for recreational and intrinsic values, will require due diligence. Cooperative management of the Snake River should continue to include all local, state and federal agencies and interested non-governmental entities.